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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/775,514	02/10/2004	Jack Oon Chu	YOR920010308US3 (16315B)	1038
23389	7590	05/05/2005	EXAMINER	
SCULLY SCOTT MURPHY & PRESSER, PC 400 GARDEN CITY PLAZA SUITE 300 GARDEN CITY, NY 11530			MONDT, JOHANNES P	
			ART UNIT	PAPER NUMBER
			2826	

DATE MAILED: 05/05/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

\* JTC

<b>Office Action Summary</b>	<b>Application No.</b> 10/775,514	<b>Applicant(s)</b> CHU ET AL.	
	<b>Examiner</b> Johannes P. Mondt	<b>Art Unit</b> 2826	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 30 March 2005.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 29-59 is/are pending in the application.
- 4a) Of the above claim(s) 42-59 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 29-41 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☒ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 10 February 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>2/10/04</u> . | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Election/Restrictions*

1. *Claims 1-28 and 42-59* have been withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected group of Species (two and three), there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on March 30, 2005.

### *Information Disclosure Statement*

The examiner has considered the items listed on the Information Disclosure Statement filed 2/10/04 with the exception of 2001/0160605 (Kanazawa et al) and the non-patent literature item authored by Kasper et al, as these items were not found in the database nor in the IFW file while the examiner has not been able to get a timely copy (Osten et al, also not found in the IFW file turned out to be available and a copy has been forwarded for scanning).

Applicant is requested to provide copies of the non-patent literature items and verify the correctness of the information provided on Kanazawa et al.

### *Drawings*

2. *The drawings are objected to* under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the "said Si/SiC interface having an abrupt change in C concentration of more than  $1 \times 10^{18}$  atoms/cc over a layer thickness in the range from about 6 Å to about 60 Å" as recited in claims 29-42 must be shown or the feature canceled from the claims. No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

### ***Specification***

*The Specification is objected to* because it fails to disclose the claimed subject matter recited in claims 29-42. In particular, nowhere in the text of the Specification nor in the Drawings Applicants disclose said "Si/SiC layer interface having an abrupt change in C concentration of more than  $1 \times 10^{18}$  atoms/cc over a layer thickness in the range from about 6 Å to about 60 Å". The claimed subject matter should be recited in the remainder of the Specification or else the claimed subject matter should be removed from the claim language. The objection to the Specification will not be held in abeyance.

### ***Claim Objections***

The following is a quotation of the relevant paragraph of 37 C.F.R. 1.75 that forms the basis for the objections to the claim language made in this office action:

(d) (1) The claim or claims must conform to the invention as set forth in the remainder of the specification and the terms and phrases used in the claims must find clear support or antecedent basis in the description so that the meaning of the terms in the claims may be ascertainable by reference to this description.

**Claims 29-41** are objected to according to 37 C.F.R. 1.75(d) because the limitation "said Si/SiC layer interface having an abrupt change in C concentration of more than  $1 \times 10^{18}$  atoms/cc over a layer thickness in the range from about 6 Å to about 60 Å" as recited in claims 29-41 through lines 4-6 of claim 29 does not find support or antecedent basis in the specification. In particular, there is no disclosure, in text or graphical representation, of a substrate with single-crystalline silicon upper surface and a Si/SiC interface having a profile of the C concentration of more than the claimed  $1 \times 10^{18}$  atoms/cc over a layer thickness from about 6 to 60 Å.

### ***Claim Rejections - 35 USC § 112***

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. **Claims 29-41** recite the limitation "said Si/SiC layer interface" in line 4 of the independent claim 29. There is insufficient antecedent basis for this limitation in the claim.

5. **Claims 33, 35, 36 and 40** recite the limitation "said p-type dopant profile" through lines 2-3 of claim 33. There is insufficient antecedent basis for this limitation in the claim.

***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. **Claim 29** is rejected under 35 U.S.C. 103(a) as being unpatentable over Swanson et al (6,552,375 B2). Swanson et al teach a layered structure comprising: a substrate 202/204/206 having an upper surface of single crystalline Si (the upper surface 206 is single crystalline, see note below) (col. 5, l. 49 – col. 6, l. 12 and col. 4, l. 66 – col. 5, l. 12: N.B.: lattice mismatch between the collector 206 and any other layer above it is disclosed: for this there has to be a definite lattice constant value on its upper surface), a layer of SiC 218 (col. 6, l. 52-65) over said upper surface, and a Si/SiC interface (interface between 218 and Si buffer 216: col. 6, l. 1-5) having an abrupt change in C concentration of more than  $1 \times 10^{18}$  atoms/cc over a layer thickness that overlaps with the claimed range of 6 to 60 Å (N.B.: the atomic number density of silicon is  $5 \times 10^{22}$  atoms/cc; the range of the stoichiometric parameter X in  $\text{Si}_{1-x}\text{C}_x$  (for instance  $X=0.002$  corresponds to a concentration of 0.002 times said atomic number density, i.e.,  $1 \times 10^{20}$  atoms/cc and the relation between X versus concentration is linear throughout the range) overlaps with the range as claimed; while the thickness is about 0 – 100 Å, in

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particular 50 Å: see col. 6, l. 26-43) in 216, it can be concluded that said interface has an abrupt change in C concentration as claimed and over a layer thickness that overlaps with the claimed range.

Applicant is reminded that a *prima facie* case of obviousness typically exists when the ranges of a claimed composition overlap the ranges disclosed in the prior art or when the ranges of a claimed composition do not overlap but are close enough such that one skilled in the art would have expected them to have the same properties. In re Peterson, 65 USPQ2d 1379 (CA FC 2003).

Because the stoichiometric quantification of said interface layer 216 is characterized by zero oxygen concentration the final limitation of claim 29 is also met.

8. **Claim 30** is rejected under 35 U.S.C. 103(a) as being unpatentable over Swanson et al as applied to claim 29 above, and further in view of Shindo et al (6,137,120). As detailed above, claim 29 is unpatentable over Swanson et al. Swanson et al do not teach the further limitation defined by claim 29. However, it would have been obvious to include said further limitation in view of Shindo et al, who, in a patent on a bipolar transistor (72<sup>nd</sup> aspect of the invention) teach a bipolar transistor (col. 64, l. 26-33) with single crystalline emitter, base and/or collector regions so as to improve electron mobility (col. 68, l. 31-40). *Motivation* to include said teaching by Shindo et al derives from the improvement of device speed and reduced ohmic dissipation through enhanced electron mobility by virtue of the dependence on transit time on mobility and the linear relationship between conductivity and electron mobility.

9. **Claim 31** is rejected under 35 U.S.C. 103(a) as being unpatentable over Swanson et al as applied to claim 29 above, and further in view of Tay et al (5,296,258). As detailed above, claim 29 is unpatentable over Swanson et al. Swanson et al do not necessarily teach the further limitation as defined by claim 31. However, it would have been obvious to include said further limitation in view of Tay et al, who, in a patent on a silicon carbide BiCMOS device (title and abstract) teach the selection of the CVD based polycrystalline state for the SiC emitter region 20 (col. 5, l. 10-20 and col. 9, l. 38-42) which has the advantage of relative ease of making (only a 200 degree difference in heating during the anneal is needed to achieve polycrystallinity) needed for the consequent improvement of the charge carrier mobility. *Motivation* thus stems from the achieved improvement in speed at moderate cost.

10. **Claim 32** is rejected under 35 U.S.C. 103(a) as being unpatentable over Swanson et al as applied to claim 29 above, and further in view of Fang et al (6,114,745). As detailed above, claim 29 is unpatentable over Swanson et al. Swanson et al do not necessarily teach the further limitation defined by claim 32. However, it would have been obvious to include said further limitation in view of Fang et al, who teach the SiC emitter region 40 in a bipolar transistor to be topped by an abutting silicon layer 38 so as to create an emitter contact region (col. 3, l. 2-31). Inclusion of the teaching in this regard by Fang et al in the invention by Swanson implies the selection of polysilicon, hence of silicon, for emitter contact region 126 and is motivated by the more gradual transition in resistivity between the emitter electrode and the silicon



carbide portion of the emitter, thus lowering the contact potential, which is the essence of any contact region.

### ***Conclusion***

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure: Sato (6,049,098).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Johannes P. Mondt whose telephone number is 571-272-1919. The examiner can normally be reached on 8:00 - 18:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan J. Flynn can be reached on 571-272-1915. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


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April 28, 2005

Patent Examiner:

A handwritten signature in black ink, appearing to read 'J. Mondt', with a stylized flourish at the end.

Johannes Mondt  
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